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Using Electricity in Iowa Farm Homes

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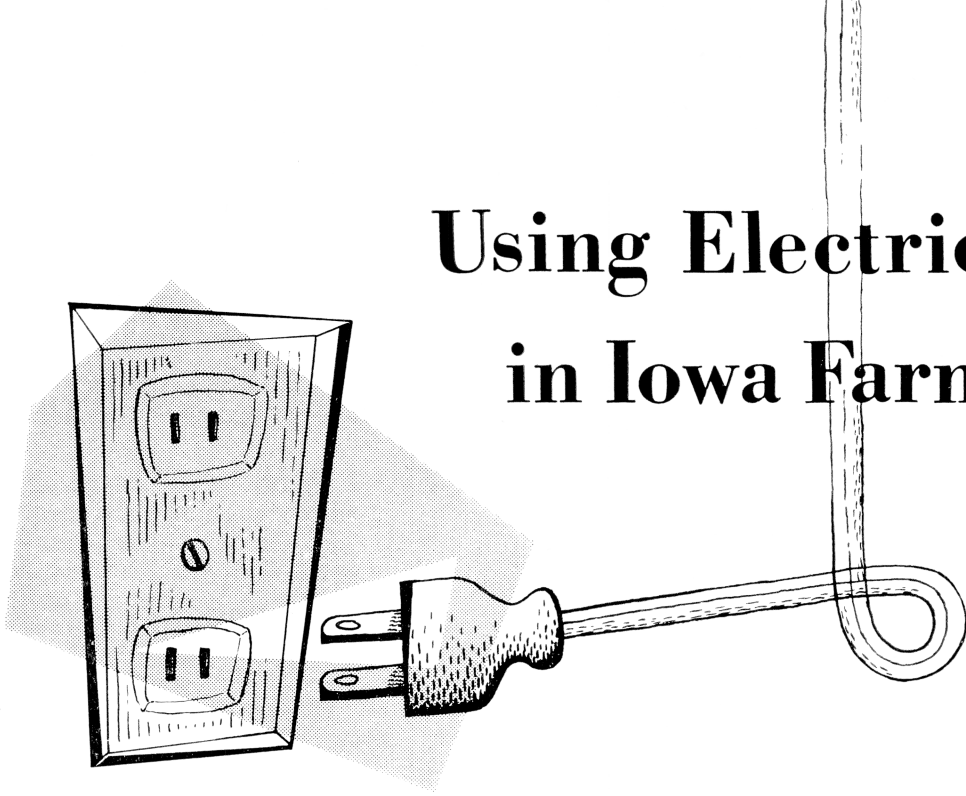

by David L. Calderwood and Kenneth L. McFate

WHEN YOU pay your regular electric bill, have you ever wondered how much of the total energy used should be charged against the home or individual home appliances — ranges, water heater, freezer? If so, the information in this article may be helpful in making estimates for your home.

The information given here was obtained on 11 farms which cooperated with Iowa State College and power suppliers by showing their neighbors how they used electricity. The map shows the locations of these farms. Kilowatt-hour meters were installed on each farm so as to show the energy consumption of the larger appliances and the total for the home.

Energy Used . . .

As shown in chart 1, the annual electrical energy usage for these farms made a general increase each year from 1942 to 1952. The largest increases were immediately following World War II when many "long-awaited and hard-to-get" home appliances became available.

How the electrical usage was apportioned between the homes and elsewhere on the farms is not indicated on this chart, but during the period in which meters were installed, usage in the homes varied from a high of 79 percent for one farm to a low of 45 percent on another farm. Home consumption was relatively steady when compared with farmstead consumption which varied widely with seasonal use.

Home Appliances . . .

Refrigerators: All farms used electric refrigerators which were metered for 1 or more years. The monthly energy consumption data are shown in chart 2. Nearly all of these units reached peak monthly consumption during the warm months of July and August.

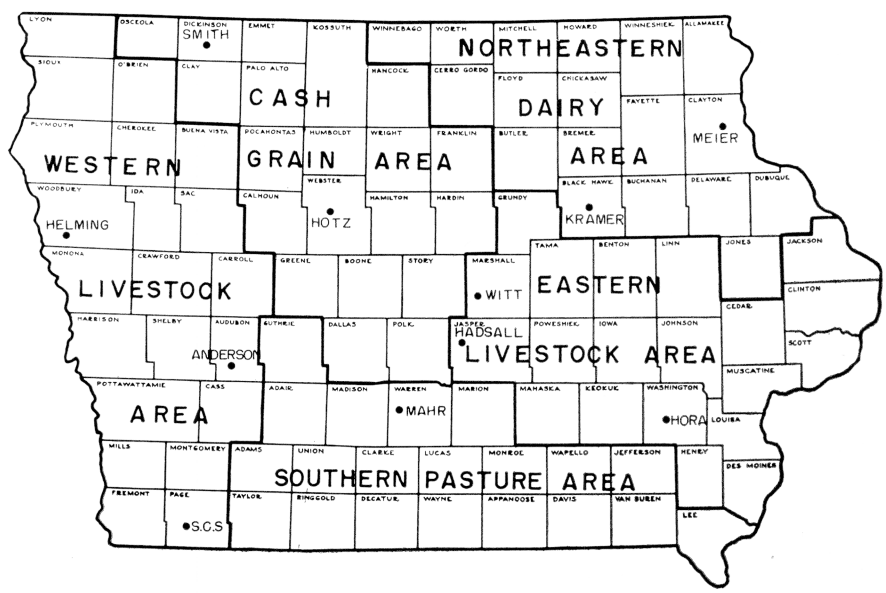

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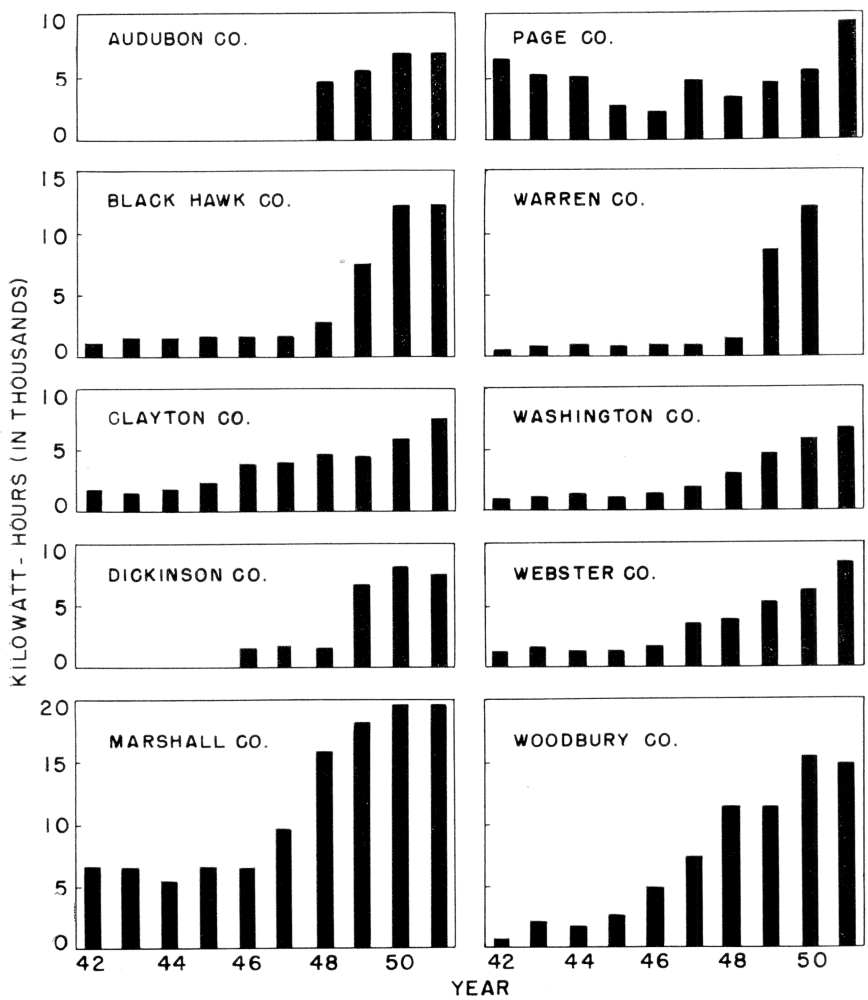
TABLE 1. Summary of Monthly Operational Data on Storage-Type Water Heaters

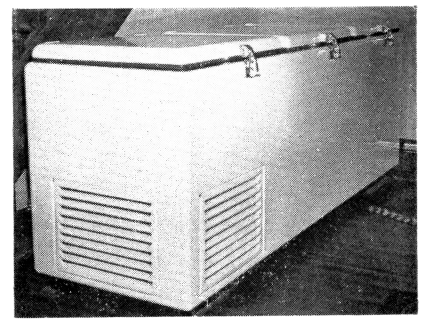
Farm	Tank size (gallons)	Temp. rise (degrees F.)	Av. energy used (kwh per month)	Water heated (gallons per mo.)	Water heated (gal. per mo. per person)	Water heated (gallon per kwh)
Audubon Co.	40	96	250	706	118	2.8
Black Hawk Co.	52	94	237	492	123	2.1
Dickinson Co.	52	—	211	655	218	3.1
Jasper Co.	52	—	256	636	212	2.5
Marshall Co.	40	102	248	935	187	3.8
Page Co.	52	96	311	848	424	2.7
Warren Co.	30	78	268	1,178	236	4.4
Woodbury Co.	52	96	286	861	287	3.0
Average	46.25	94	258	789	225	3.05

Average consumption for each refrigerator is shown along with the size of the unit. However, energy consumption didn't necessarily depend on the size. The largest unit, 10.7 cubic feet, used an average of 27.6 kwh per month. An 8-cubic-foot unit used 50 kwh per month, while four 6-cubic-foot units used 17, 21, 37 and 44 kwh respectively. (The 6-cubic-foot unit using 44 kwh per month was recessed in a wall niche where ventilation was extremely poor.)

Home freezers: The monthly energy consumption for eight home freezers, their location in the home and the size of each unit are shown in chart 3. The average electrical energy consumption for different units varied from 3.56 to 6.27 kwh per cubic foot of space per month.

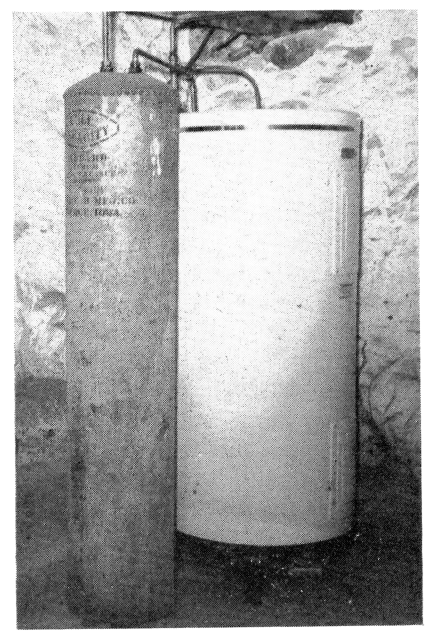
CHART 1. Annual Electrical Consumption





Freezers located in basements used less electricity in proportion to size than did those located on the first floor. The latter, however, were more convenient for the housewife and probably were opened more often.

Electric ranges: Monthly energy consumption of ranges used on 8 of the 11 demonstration farms is shown in chart 4. Average monthly usage varied from a low of 79 kwh to a high of 161 kwh and is shown for each range. The average for all eight ranges was 113 kwh per month. Food was prepared for an average of four to five people in each of the homes.



Water heaters: Storage-type electric water heaters were metered for 1 or more years on eight farms; the results are shown in table 1. Energy consumption varied with the amount of water heated, the temperature rise (difference between temperature of the heated water and that of the

CHART 2. Refrigerators

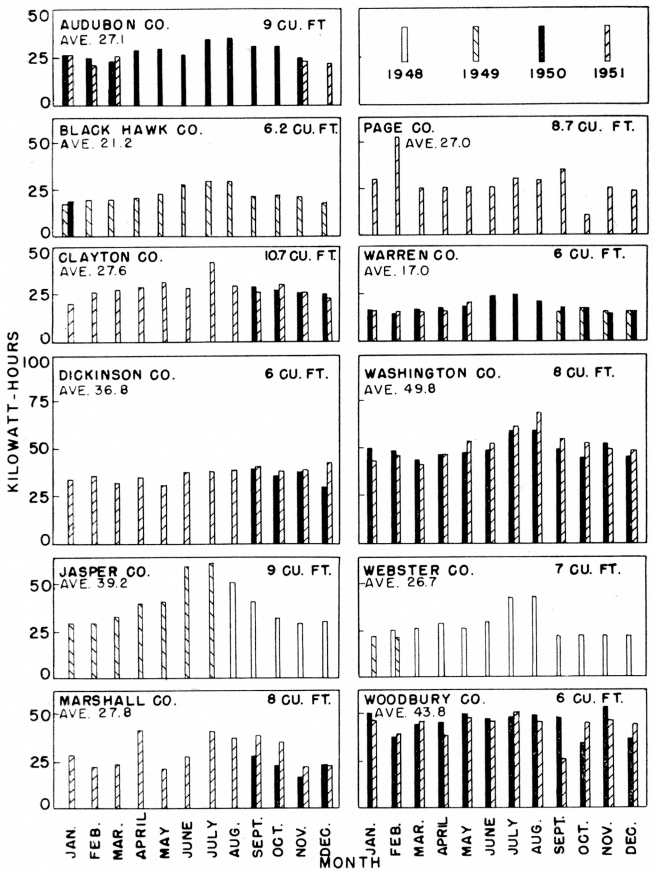


CHART 3. Home Freezers

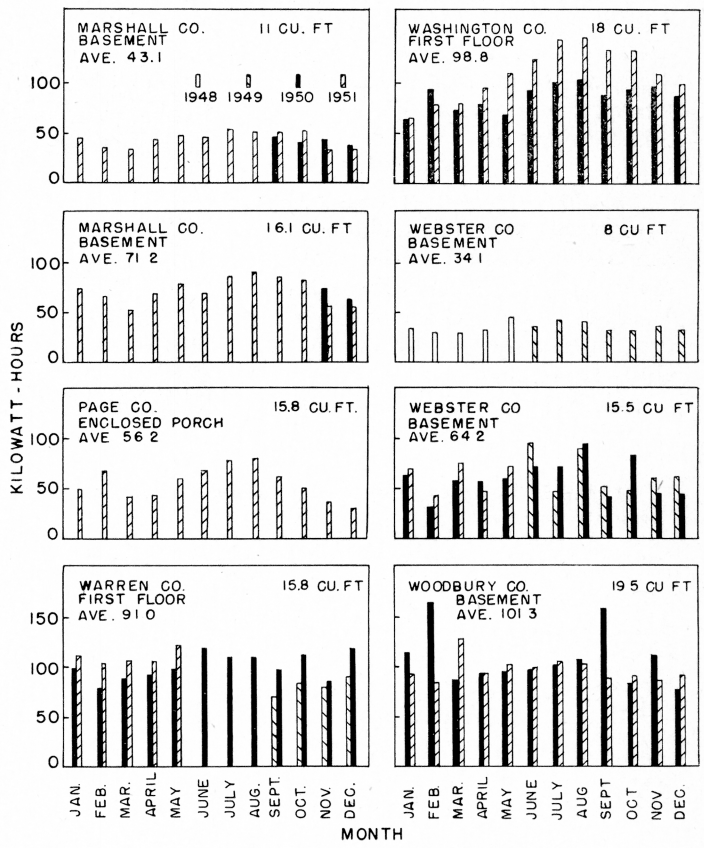


CHART 4. Electric Ranges

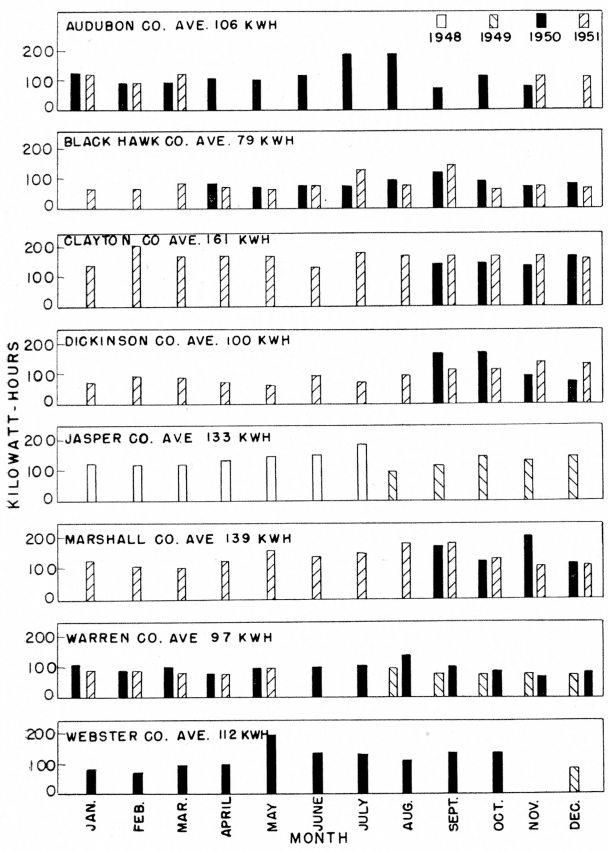
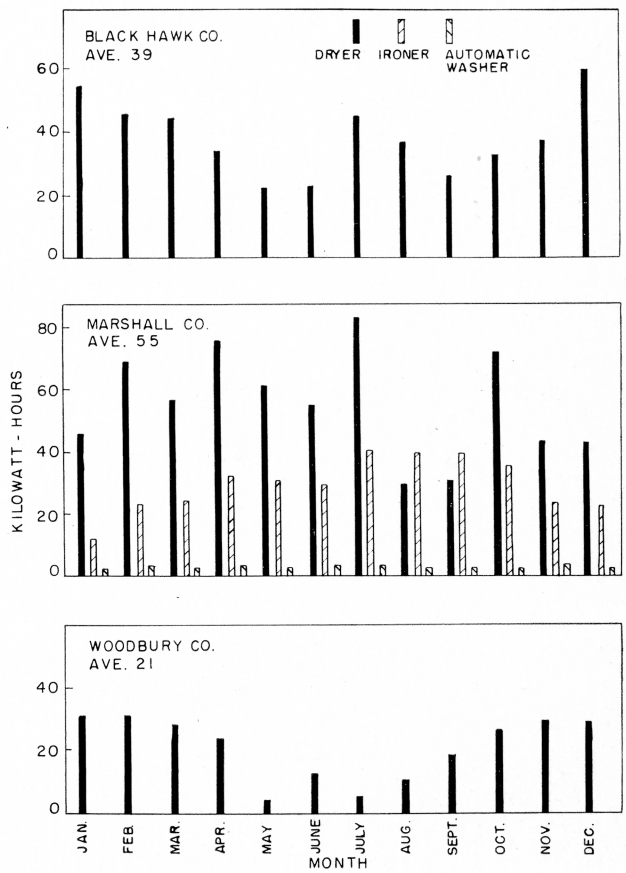


CHART 5. Laundry Equipment



ground water), amount of exposed hot water lines and water heater design features. (A special study showed that three peak electrical loads due to hot water heating occurred at 8 to 9 a.m., 12 to 1 p.m., and 7 to 8 p.m.)

Laundry equipment: Laundry equipment metered included an automatic washer, three clothes driers and an ironer. The graphs in chart 5 show the monthly energy consumption for each of these appliances.

Electrical energy consumption for the clothes driers averaged 39, 55 and 21 kwh per month on the Black Hawk, Marshall and Woodbury county farms respectively. The lowest consumption was due to summer "on-the-line" drying. Average monthly energy consumption was 29 kwh for the ironer and 4.25 kwh for the automatic washer on the Marshall County farm.

Dishwasher: During 16 months of operation on the Marshall County farm, 49 kwh of electrical energy were used by the dishwasher. This is an average of 3.1 kwh per month for washing dishes for a family of 6.

Home heating systems: Several types of central heating systems were used on these rural electric demonstration farms. Some used electricity for circulating heat by means of a warm air fan or a hot water pump. Electricity also was used for injecting fuel in furnaces with a coal stoker or a gun-type oil burner.

Descriptions of the heating system, number of rooms in the dwelling and the average seasonal energy consumption are shown in table 2. Much of the variation in electrical energy consumption for different heating systems was due to the number of rooms being heated to normal home temperature.

Special range study: On the Webster County farm, a special study on the operation of a liquid petroleum (LP) gas range and an electric range was made because of interest among farm people. First, a new LP gas range was used for several months. Then the gas range was replaced with an electric range. Fuel, electrical energy and daily use data were accurately recorded for almost a year for each range. Results are recorded in tables 3 and 4.

No effort was made to control the use of either range, but the same homemaker used both units and cooked for the same family of five. However, water was heated occasionally for general household use on these ranges—on 42 days with the electric range and on only 14 days with the LP gas range.

Average consumption was 1.2 lbs. and 3.7 kwh per day for the LP gas and electric ranges, respectively. Daily costs can be figured by applying local rates.

TABLE 2. Summary of Electrical Energy Consumption of Heating Systems

Farm:	Black Hawk County	Clayton County	Dickinson County	Jasper County	Marshall County	Webster County	Woodbury County
Type of furnace:	Oil burner with fan	Oil burner with hot water pump	Coal stoker with fan	Oil burner with fan	Oil burner with hot water pump	Hand-fired furnace with fan	Hand-fired furnace with fan
Rooms in dwelling:	7	8	6	6	7	7	7
Av. energy used per season (kwh)	590	305	313	388	1,092	162	159

TABLE 3. Operation of LP-Gas Range in Webster County Farm Home

Period per tank[a]	Days	Lbs. gas per day	Meals served		
			Breakfast	Lunch	Supper
1948-1949 Oct. 4 to Dec. 27	85	1.18	382	229	412
Dec. 27 to April 2	96	1.04	476	317	481
April 2 to June 23[b]	82	1.22	365	235	394
June 23 to Sept. 5	74	1.35	312	258	332
Total	337		1,535	1,039	1,619

Av. number of meals per day, 12.4.
Av. lbs. gas per day, 1.2.

[a]Tanks contained 100 lbs. of liquefied petroleum gas.
[b]Water heated on range for general household use 14 days during this period.

TABLE 4. Operation of Electric Range in Webster County Farm Home.

1949-50	Days	kwh	kwh per day	Meals served		
				Breakfast	Lunch	Supper
Dec.	31	81	2.62	142	90	116
Jan.	31	82	2.65	128	74	136
Feb.	28	73	2.60	106	76	130
March	31	96	3.10	..... Not recorded		
April	30	95	3.16	150	101	162
May[a]	31	189	6.10	106	128	167
June[b]	30	128	4.20	154	147	157
July[c]	31	128	4.20	155	134	161
Aug.	31	104	3.35	146	108	123
Sept.	30	129	4.30	150	98	145
Oct.	31	130	4.20	104	84	171
Total	335	1,235		1,393	1,040	1,468

Av. meals per day (less March), 12.8.
Av. kwh per day, 3.7.

[a]Water heated on range for general household use, 31 days.
[b]Water heated on range for general household use, 9 days.
[c]Water heated on range for dressing poultry, 2 days.